

# Using Geography and Geographic Information Systems to create and operate Self Sustaining Forward Operating Bases.

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*May 2011*



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## **Fact 13:**

**The American GI is the most energy consuming soldier ever seen in the field of war.**

- **15 Gal/Day of fuel/deployed soldier**
  - Energy is our advantage
- **\$400/Gal. fully burdened cost of fuel**
  - Energy is our weakness
  - **The Energy Fight: This tactic involves building and energy advantage and then converting that energy to a snapshot position.**  
(Fighter Combat: tactics and maneuvering, R.L. Shaw)
  - **CNO (ADM Gary Roughead): When I was a commander, I had a sign put over every one of my air controllers that simply said, “think gas.” You can’t operate in that environment with those types of machine and not always have your mind on the source of energy and power. We have to be able to look at ways to extend the capability, the capacity, the duration of the machines that we operate.**

# New Reality

- Air Combat Related Aerodynamics: The concept of energy awareness is fairly new. Wise use and conservation of energy during combat will increase your chances of victory. (Official F-15 Strike Eagle Handbook)
- DoD and its allies can become an even more powerful force when we learn to use energy strategy as yet another arrow in our quiver. Dan Nolan (DoD Energy Blog)

# Climate Change and Military Energy Requirements

- Climate change yields destabilization in a geographically predictable way
- Destabilization yields conflict in a geographically predictable way
- Conflict yields deployment to that geography
- Geography dictates forward basing location options
- Geography dictates energy requirements (lighting, heating, cooling, mobility, security, logistics)
- Geography dictates energy conservation options (insulation, swamp coolers, supply options)
- Geography dictates energy options (oil, wind, solar, hydro, geothermal, biomass, etc.)
- Plan with geography to maximize military advantage in future deployments

# Expeditionary Site Selection Process (today):

Headquarters Air Combat Command

## Expeditionary Site Mapping (ESM) Application



Mark Cave  
USAF ACC IG&S  
Contractor - AECOM, Inc.  
ESRI FEDUC  
February 2010

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## CSAF Requirement

ESM - Global Mobility Support

- Global Mobility Concept of Operations calls for capability to:
  - Provide assets around the globe anytime, anywhere
  - Provide tailored capabilities to stand-up and sustain combat operations at prepared and austere locations
  - Capability to rapidly assess an airbase
  - Perform pre action assessments
  - Plan base layout

"Collect/update data on runway and base infrastructure from airfields, remote and en-route to provide runway and basing capability and capacity, at frequent intervals prior to crisis development. Perform pre-action assessment. Maintain Worldwide awareness of airfield capabilities to support mobility operations" Para 5.1.1.2.1, GM CONOPS



## Air Expeditionary Forces Strategic Doctrine



## GeoReach Program



## User Features – Basic Search

The screenshot displays the Expeditionary Site Mapping Tool interface. The top section shows the browser window with the URL: <https://www.afm.af.mil/georeach/esmportal/#main=93492812962965407=CED4CQ4Jm=9900main=6167652237900046jrm=327061716730623security=4Fjrm=327171411>. The main interface is divided into two panels: a **Basic Search** panel on the left and a **Map** panel on the right.

The **Basic Search** panel includes the following fields:

- ADR:** AECOM
- Country:** Afghanistan
- Name:**
- Runway Length (Feet):** Min: 8000, Max:
- Runway Width (Feet):** Min: , Max:

Below the search fields are buttons for **Run Search**, **Clear Results**, and **More Search Options**.

The **Map** panel displays a satellite view of a desert landscape. A yellow line indicates a search path. A pop-up window shows details for a location named **BAQMAN**, including its name, elevation, length, width, and country.

At the bottom, there is a table of search results:

Country	Name	Length (feet)	Width (feet)	NRCS	Latitude	Longitude
AF	HAZAR & DHA	10433	144	428V45008702	36.70401309	67.20967773
AF	B-HERR YD	51000	113	428V46153341	34.77900278	67.48669722
AF	BAQMAN	51619	150	428V4542820	34.8419	67.21271944



# Sustainable Expeditionary Site Selection Process:

Headquarters Air Combat Command

## Expeditionary Site Mapping (ESM) Application



Mark Cave  
USAF ACC IGI&S  
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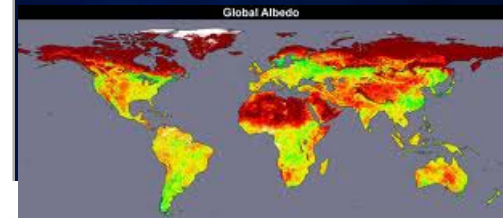
## Air Expeditionary Forces Strategic Doctrine



## GeoReach Program



**Sustainability Function**



**Energy Mission Data Sets**



## User Features –

The screenshot shows the 'Expeditionary Site Mapping Tool' interface. It includes a search bar, filters for 'ADR' (set to 'CENTCOM'), 'Country' (set to 'Afghanistan'), and 'Name'. There are also input fields for 'Runway Length (Feet)' and 'Runway Width (Feet)'. A 'Map' section displays a satellite view of a desert landscape. Below the map, a table shows search results with columns for 'Country', 'Name', 'Length (Feet)', 'Width (Feet)', 'MGRS', 'Latitude', and 'Longitude'. The table lists three results: 'HAZAR & SHAH', 'SHARER TO D', and 'BAQRAH'.

Country	Name	Length (Feet)	Width (Feet)	MGRS	Latitude	Longitude
AF	HAZAR & SHAH	10420	146	42SU440007 60	36.71001309	67.20967770
AF	SHARER TO D	11000	113	42SU46153384	34.77903278	67.48669732
AF	BAQRAH	11619	120	42SU424206 24	34.9439	69.21791944

# Sustainable Expeditionary Site Selection Requirements:

- Mission Data Set:
- Solar Density
- Wind Density
- Biomass Resources
- Geothermal Resources
- Hydro Resources
- Tidal Resources
- Etc.

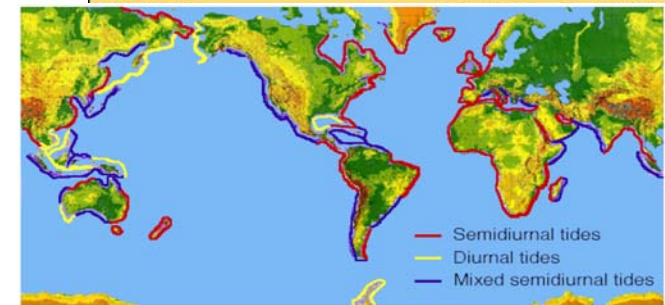
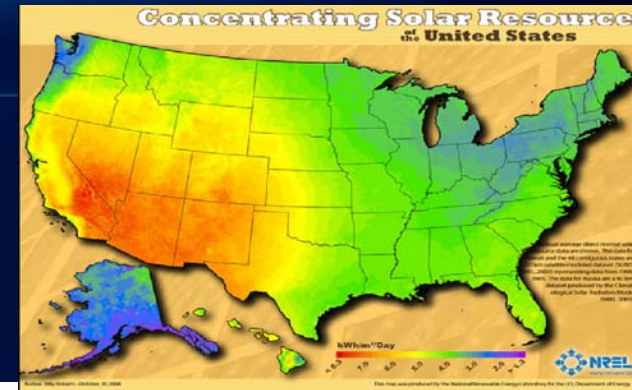


Figure 1-3 Global Distribution of Tidal Regimes

S. Hese et al. / Remote Sensing of Environment 94 (2005) 94–104

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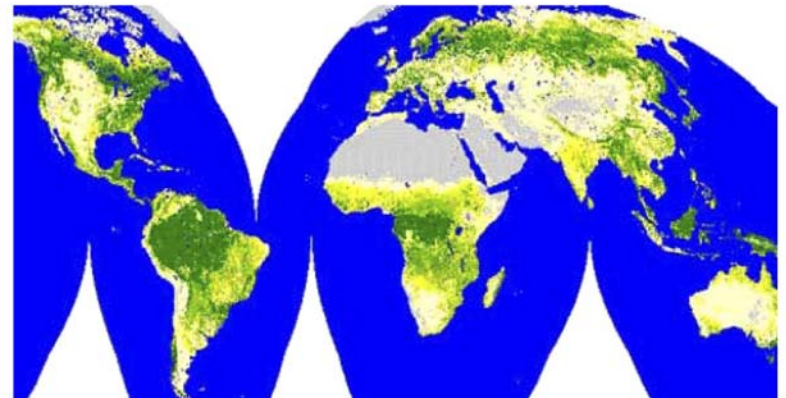


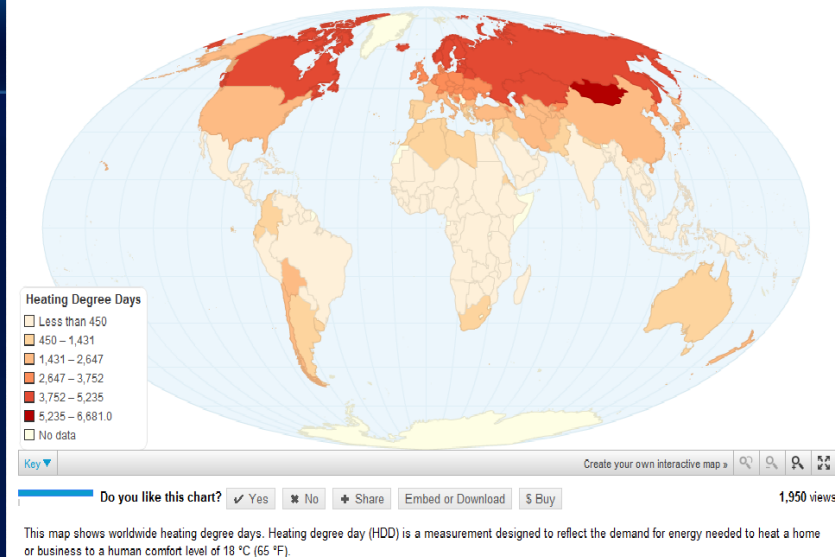
Fig. 1. Global Tree Cover in percent (white: 0%; dark green: 100%) retrieved from NOAA AVHRR (from DeFries et al., 2000). Uncertainties exist for global forest cover estimates (between 30 and 60 Mio km<sup>2</sup>) and carbon stored in different types of forests (stock ranges from 100 to 400 tC/ha with biome). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article).



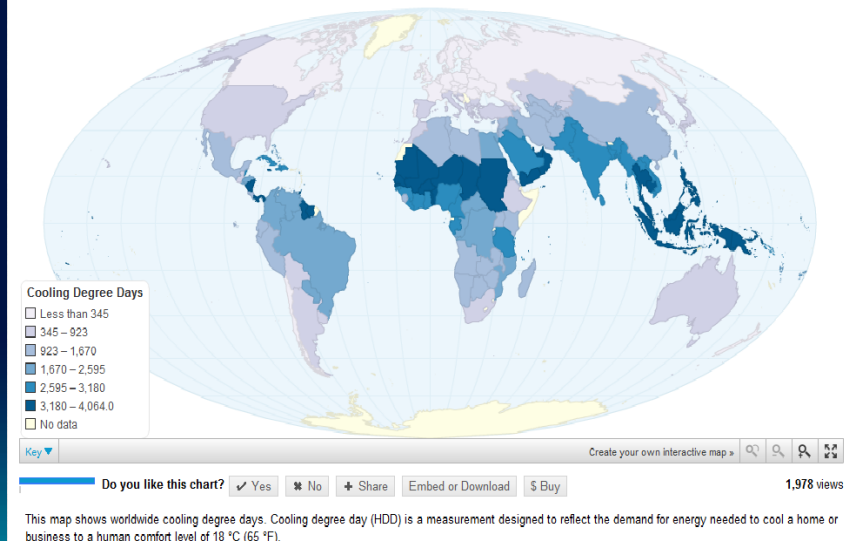
# Sustainability Mission Data Set

- Degree Heating Days
- Degree Cooling Days
- Rainfall Patterns
- Roads (supply lines)
- Mobility
- Refineries
- Ports

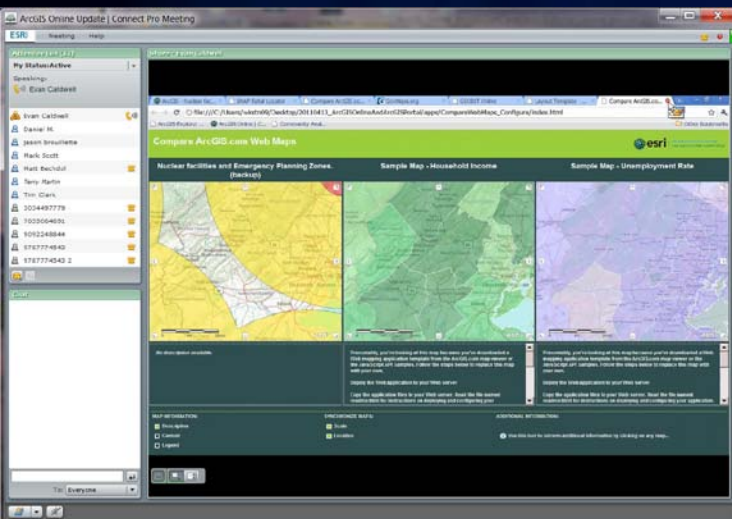
Worldwide Heating Needs



Worldwide Cooling Needs

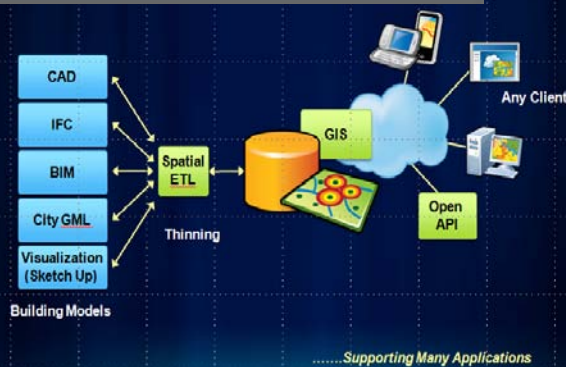


# Existing technology and functionality already deployed....just adding capabilities



## Application Components

- Adobe Flex API
  - Adobe Flash
- Leverages ACC Architecture
  - ESRI ArcGIS Server 9.3.1 Cache Tiles
  - ESRI ArcSDE Single Schema & Database Replication
  - DISA Global Information Grid (GIG) Content Delivery Service
    - Edge Serving
    - Performance Bursting
- Global Combat Support System – AF (Unclass only)
  - Security Services
    - Role Based access control for need to know
  - AF Portal Reduced Sign
    - .com & .mil access vi

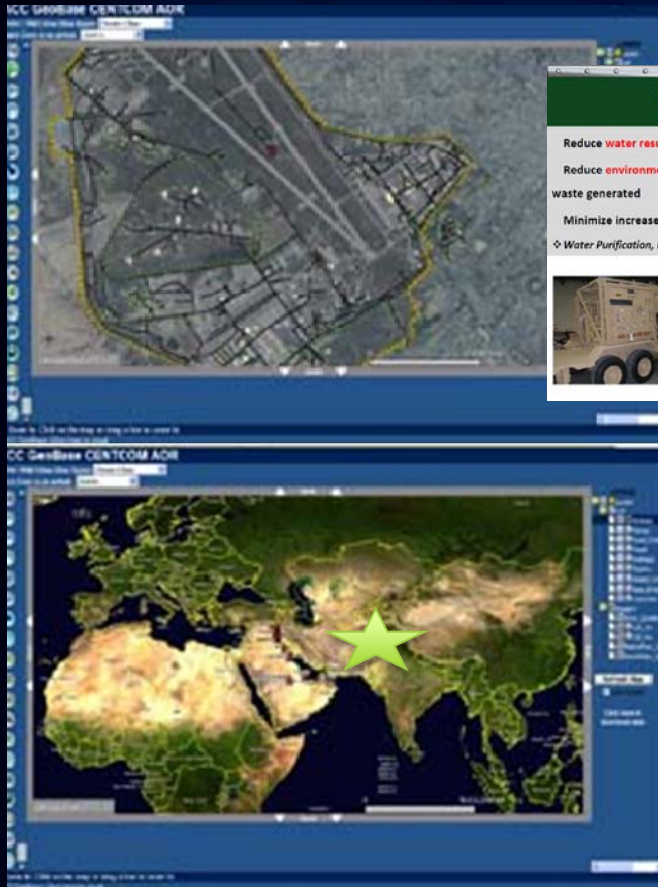


## Managing, Analyzing & Visualizing Building Data at All Scales





# Matching site requirements to site capabilities:



Matching wind generators to wind density

Matching solar panels to solar density

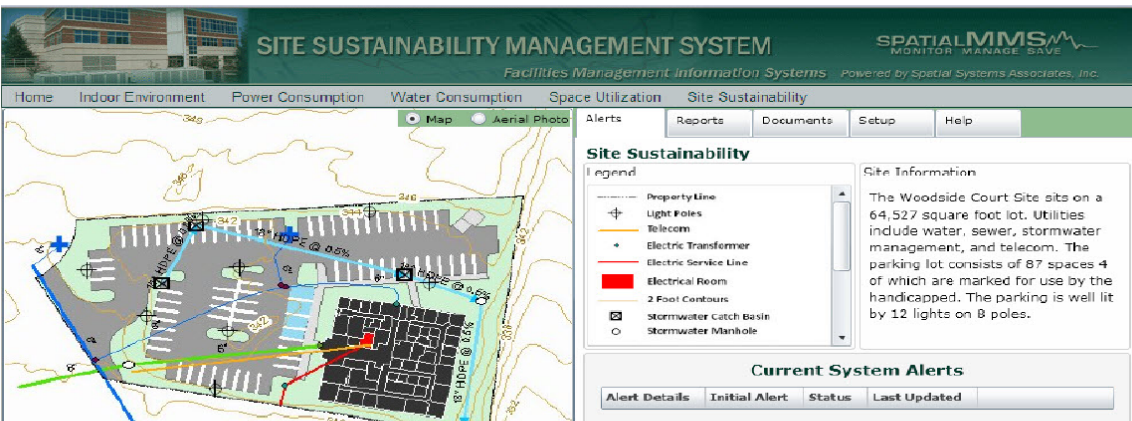
Scaling systems to geographic needs for heating days cooling days...



# Optimizing Base Operations:

## Site Sustainability

The Site Sustainability portion of SpatialMMS is tailored to track the information necessary for USGBC building certification and for facility operations. When the user selects the Site Sustainability pull-down from the main page, the following screen is displayed:



Linking Industrial Control Systems, Meters, Sensors to provide Situational Awareness and Operational Controls in 4 dimensions



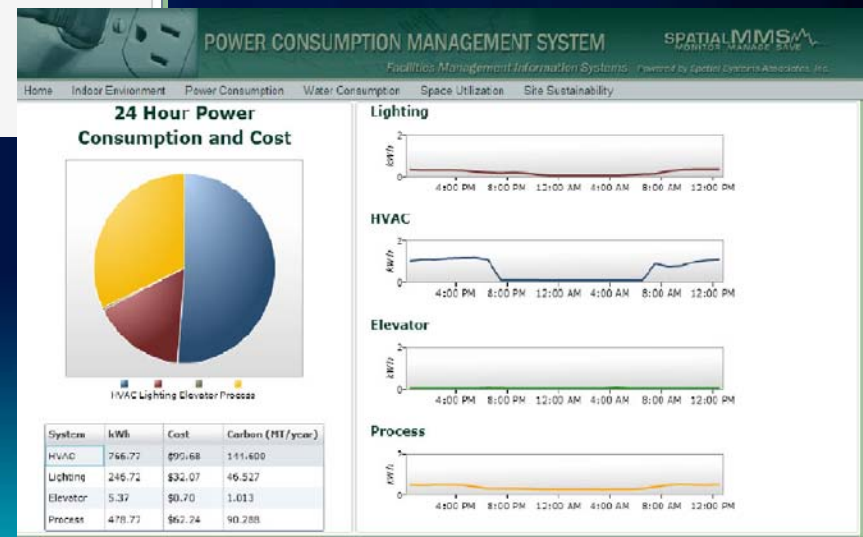
**HVAC Zone Average Temperature**

The HVAC Zone Average Temperature display depicts the average temperature within an HVAC zone based on the temperature sensors within that zone. In this case, it is evident that the entire second floor is within a common range of 68-76 degrees, which is where an operations manager would probably want it to be.



**HVAC Zone Out of Range**

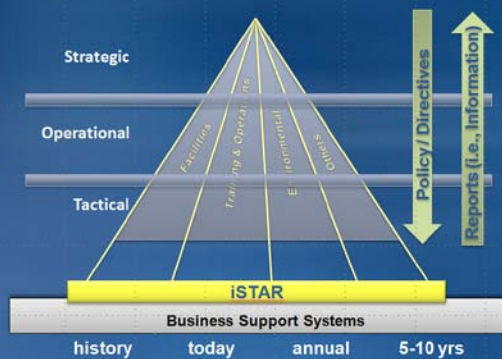
This graphic depicts color coding of the individual zones as a function of the temperature sensor acceptability range. If any sensor within the HVAC zone is too hot, then it is assumed the entire zone is too hot and the zone is depicted in red. If any sensor within the HVAC zone is too cold, then the entire zone is depicted in blue. If any one sensor is too hot and another



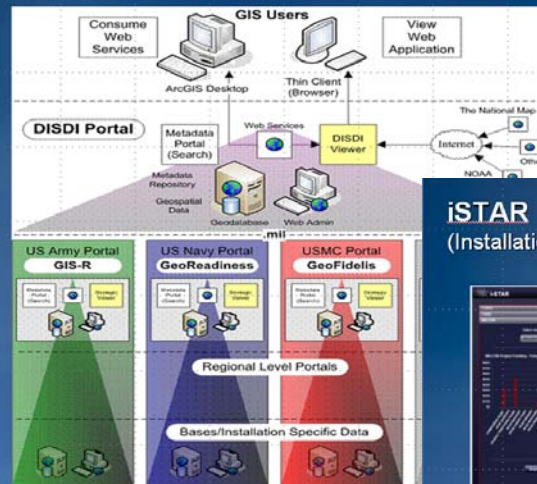


# Optimizing Theatre Operations:

Enterprise



## Federated DISDI Architecture



## iSTAR (Installation Statistics, Analysis, and Reporting)





**Technology**  
**Empowering the warfighter:**  
**More tooth**  
**Less tail**



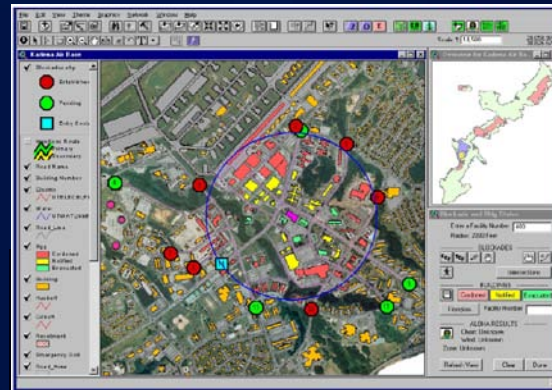
## **Key Points:**

- **Climate Change cause and effects are Geographically predictable**
- **In other words: Sustainability is a geographically organized problem in space and time**
- **GIS is a tool for managing geographically organized problems**
- **Where and how to deploy are geographic problems**
- **GIS technology is already deployed (CJMTK, GeoBase, Expeditionary Site Selection tool, Defensor Fortis, GeoFidelis, Enterprise Licenses USACOE...)**
- **Applying GIS to the problem of Sustainable Forward Operating Bases is underway**
- **This approach is consistent with Energy Savings, Sustainability Goals, EMS, Transparency, and Cost Savings**

# A Complete System for sustainable OPS

## Mission Support

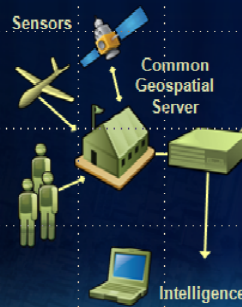
Easier  
More Powerful  
and Everywhere



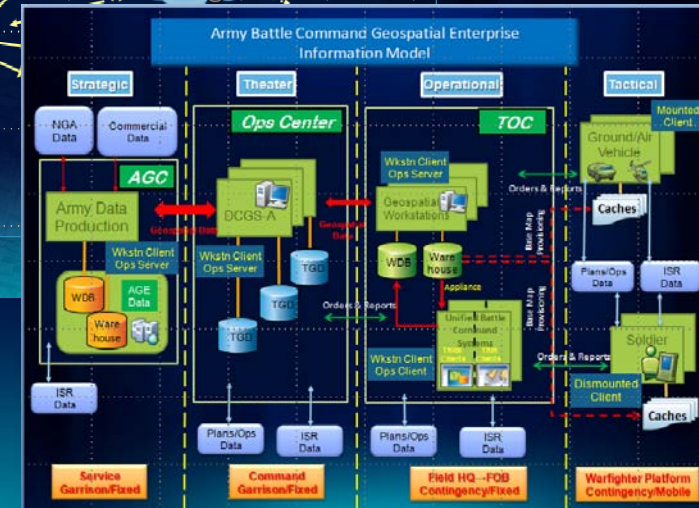
Warfighter

ISR Programs  
(DCGS-A)

C2 Programs  
(CPOF...AFATDS...FBCB2/JCR/JBC-P)



Enterprise





# Questions?

## esri & IGI&S — A Longstanding Partnership

Deploying Our Software ...

.....Collaborating On Projects, Research And Programs

- USACE – since 1973
- ELA – 2010
- USAF GeoBase – BPA since 2005
- USMC GeoFidelis – Camp Lejeune is #188
- US Navy GeoReadiness (NAVFAC) – NFESC is #993
- US Army IGI&S
- DISDI – supported from the beginning

... And Countless other efforts supporting Operational Readiness

1990 1995 2000 2005 2010

....Thank You For This Ongoing Relationship

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